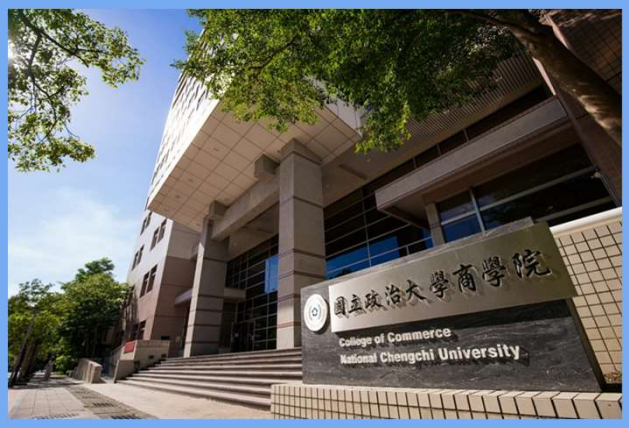
國立政治大學資訊管理學系
NCCU DEPARTMENT OF MANAGEMENT INFORMATION SYSTEMS

Introduction to Computer Science

Week 3- Computer Hardware II



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RFID

RFID (radio frequency identification): uses radio signals to communicate with a tag placed in or attached to an object

RFID reader: reads information on the tag via radio waves

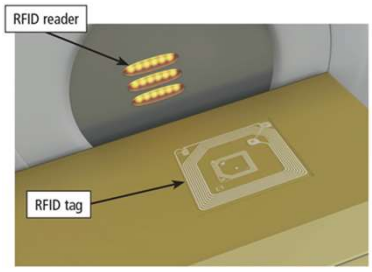
- Tracking times of runners in a marathon
- Tracking location of people and other items
- Checking lift tickets of skiers
- Gauging temperature and pressure of tires on a vehicle
- Checking out library books
- Managing purchases
- Tracking payment as vehicles pass through booths on tollway systems

2

RFID

RFID tag : consists of an antenna and a memory chip that contains the information to be transmitted via radio waves

RFID reader reads radio signals and transmits the information to a computer or computing device



iStockphoto.com / luismmolina

3

NFC (near field communication)

An NFC-enabled device contains an NFC chip

An NFC tag contains a chip and an antenna that contains information to be transmitted

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4

What Is Output?

Data that processed into a useful form

- Display
- Monitor
- Speakers
- Headphones
- Projectors
- Voice synthesizer
- Printers

Image by Michal Jarmoluk from Pixabay

5

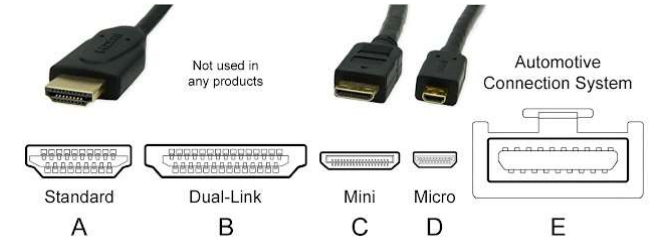
Display Ports

The monitors today use a digital signal to produce a picture

The monitor should plug in display ports to display the highest quality images:

- VGA port
- DVI port
- HDMI port
- DisplayPort

https://ofeyhong.pixnet.net/blog/213474559



https://en.wikipedia.org/wiki/HDMI

More details: https://www.youtube.com/watch?v=3LoGJZmyfpA
http://www.brucebnews.com/2014/08/the-confusing-world-of-videovga-dvi-hdmi-displayport/

How Computers Represent Images

Pixel (picture + element)

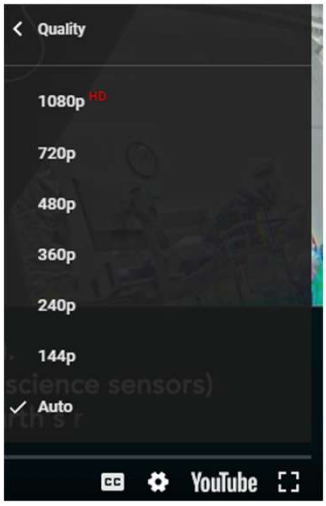
- The smallest picture elements
- Each color is assigned to a binary num
- white:11, black:00

The resolution of the video file is width x height

- The higher the resolution, the clearer the video
- Standard definition (SD): 640 x 320, 720 x 480
- High definition (HD): 1280 x 720 (720p), 1920 x 1080
- 4K: 3840 x 2160 (2160p), 8K: 7840 x 4320 (4320p)

Not all devices can play 4k/8k files

- Play 4k video on 720p display, your computer will convert 4k video to 720p (the best video the screen can provide)



7

國立政治大學資訊管理學系
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Introduction to Computer Science

Week 3- Operating system

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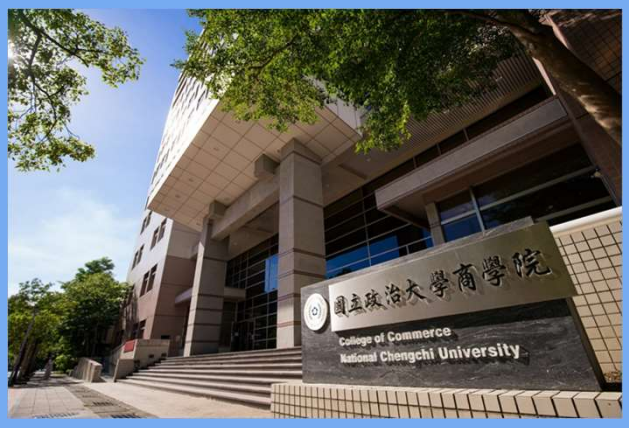
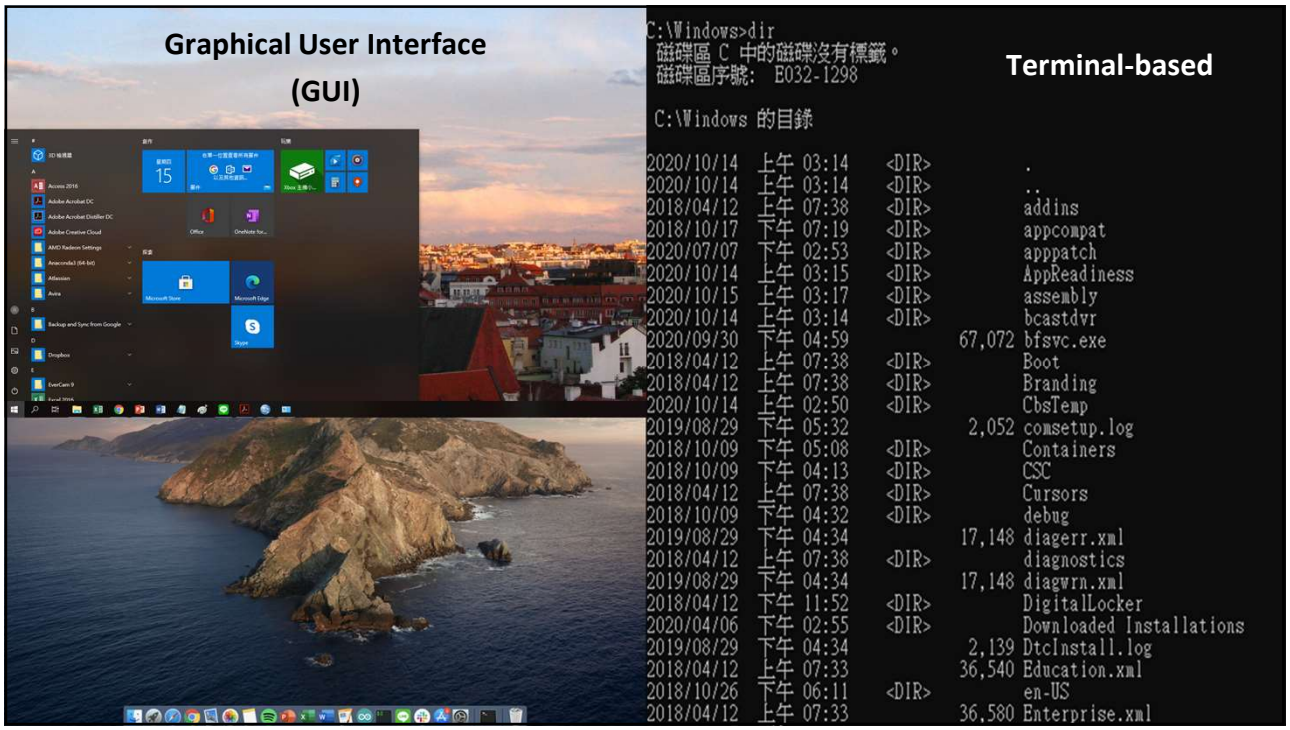




GUI (Graphical User Interface)

A form of user interface which allows users to interact with electronic devices through graphical icons and audio indicator such as primary notation, instead of text-based user interfaces, typed command labels or text navigation

https://en.wikipedia.org/wiki/Graphical_user_interface

Closed Source vs. Open Source

Closed source: keep all or some code hidden

- Programs have standard features and can only be customized using the operating system tools
- Windows and macOS

Open source: the copyright holder has no restrictions on modification and redistribution

- Users can add features and sell their versions or give away to others
- Linux, Unix, Android, etc.
- Security issues : Unscrupulous programmers added malicious code, which may damage the user's system or be used to collect data without the user's knowledge

Utilities

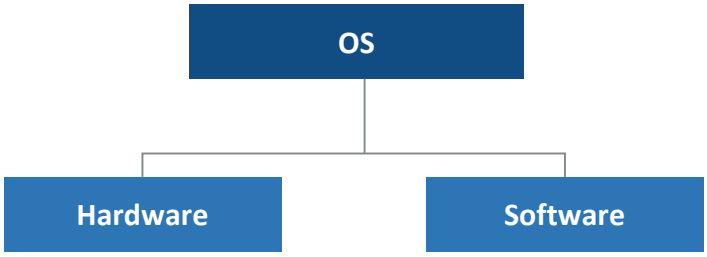
Perform maintenance-type tasks related to managing the device

- Maintain computer and devices
- Manage files
- Search for content or programs
- View images
- Install and uninstall programs and apps

OS (Operating System)

Operating system: Control the access to hardware by users

Application programs: Use the computer hardware to assist or solve users' tasks



What is OS?

Operating system (OS): A program which manages the complete operation of your computer or mobile device and let you interact with it

- A general manager **supervises** the activities of each component in the system
- A program (or a set of programs) that helps to execute other programs
- **Interface** between computer and user
- **Coordinate** tasks and **configure** devices
- Monitor performance and provide **management**

Goals : Easy to use resources and efficient to use hardware

Components of OS

Shell is a user interface for access to an OS's services

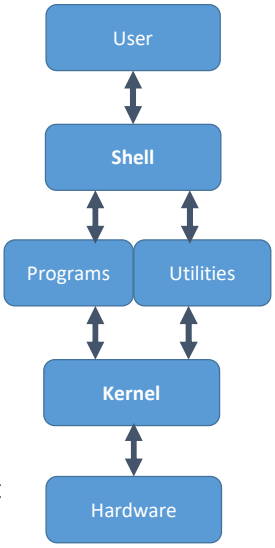
- User give shell a command
- OS can have several different shells (command-line interface or GUI)

Utilities provide a support process for users

- Common utilities: text editors, search programs, sort programs, etc.

Kernel is the heart of an OS with complete control over everything in the system

- Contain the most basic parts of OS
- Memory management, process management, device/file management
- Other components of the system call on the kernel to perform services
- If the command requires an application, the shell requests kernel to run it



Bootstrap Process

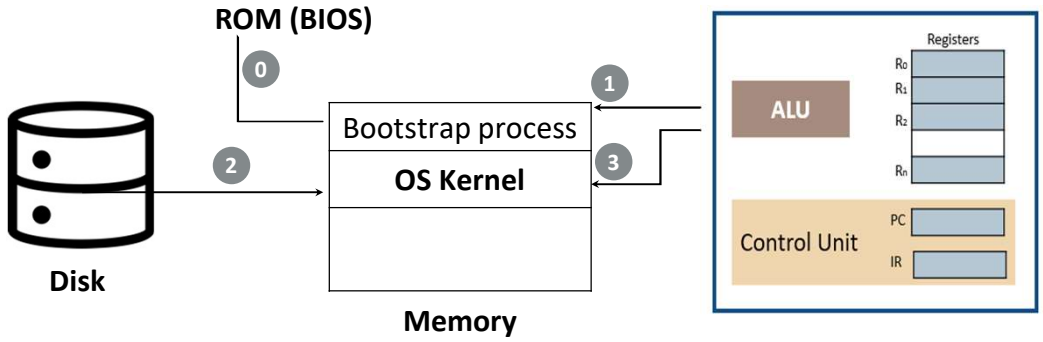
The OS itself needs to be loaded into the memory and run to load other programs into memory for execution

ROM holds a small program called the bootstrap program

- When the computer is turned on, the CPU counter is set to the first instruction of this bootstrap program and executes the instructions in this program
- Once finished, the program counter is set to the first instruction of the operating system in RAM

Bootstrap Process

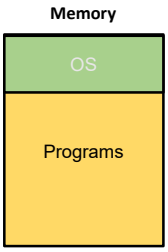
0. BIOS (basic input/output system), program counter -> bootstrap
1. Bootstrap program runs
2. Operating system is loaded
3. Operating system runs



Memory Management

Monoprogramming (belongs to the past)

- Memory capacity is dedicated to a single program
  - Only little part is needed to hold the operating system
- When one program is running, no other program be executed
  - Speed: CPU >> Input & Output
  - CPU is idle when receiving data from or sending data to devices
- If size of program > size of memory: cannot be run



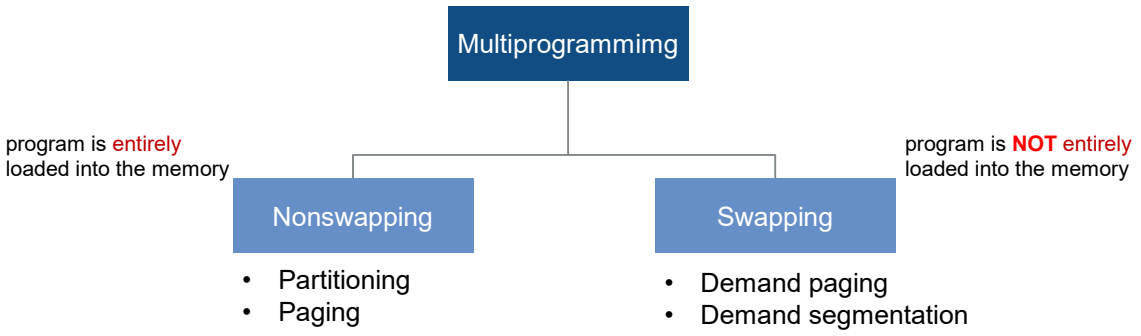
Multiprogramming (current approach)

- Multiple programs are stored in memory and executed concurrently
  - CPU switch rapidly between programs

Memory Management- Multiprogramming

Nonswapping: program keeps in memory for the duration of execution

Swapping: programs can be swapped between memory and disk



Nonswapping- Partitioning

Memory is divided into variable-length sections

- Each partition holds one program
- CPU switches between programs
  - Execute instructions of the program, until an I/O operation is encountered or the time allocated for the program expires
- Each program is entirely loaded into the memory, requiring **contiguous** locations
  - Small partition size: programs cannot be loaded into memory
  - Large partition size: holes (unused locations) in memory
  - Memory manager can compact the partitions to remove holes and create new partitions, but it takes extra costs

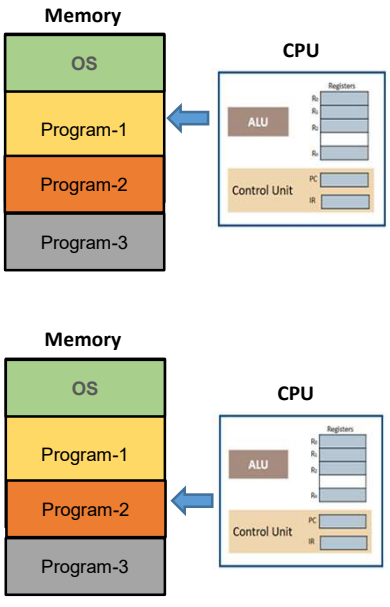


Image credit: Foundations Of Computer Science 4th edition, Behrouz Forouzan, (ISBN:1473751047)

Nonswapping- Paging

Programs are divided into equally sized sections: pages

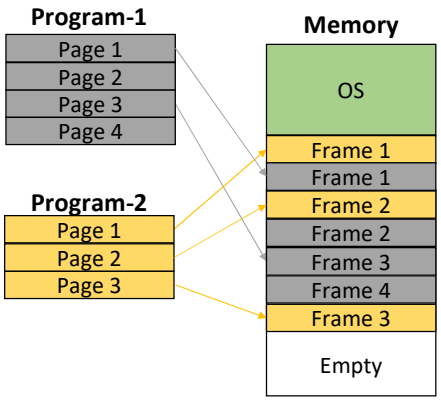
Memory is divided into equally sized sections: frames

- The size of a page/frame is the same and equal to the size of the block used by the system

Programs do not have to be contiguous in memory

- Two consecutive pages can occupy **noncontiguous** frames in memory

Paging can improve efficiency, but the **entire** program needs to be loaded into memory before execution

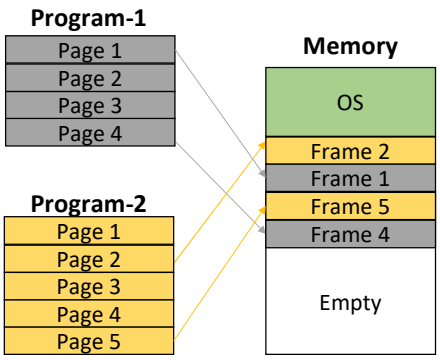


Swapping- Demand Paging

A program is divided into pages, and these pages can be loaded into memory one by one (**not entirely**), and can be executed and replaced by another page

Memory can hold pages from multiple programs at the same time

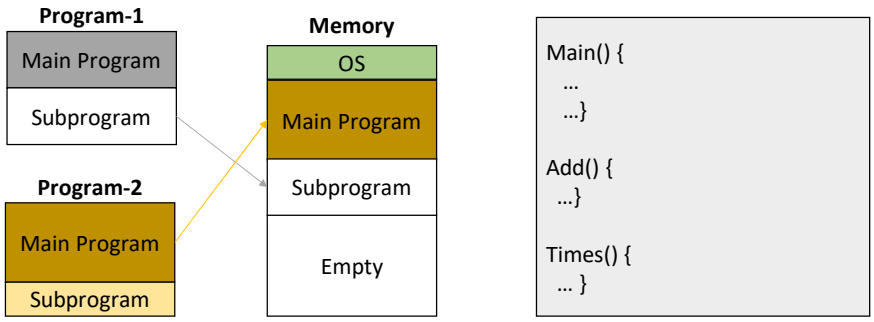
- Pages can be loaded into any free frame



Swapping- Demand Segmentation

A program is usually made up of a main program and subprograms

A program is divided into multiple segments, and the segments are loaded into memory, executed and replaced by another module in the same or different program



Process Manager

Program: a *nonactive* set of instructions stored on disk

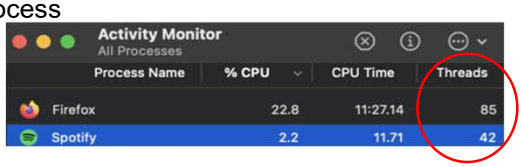
- A program may or may not become a job

Job: a program becomes a job when it is *selected for execution*

- When finished executing, a job becomes a program again
- Every job is a program, but not every program is a job

Process: a program in execution (has started but has not finished)

- A job is being run in memory
- Selected among other waiting jobs and loaded into memory
- Every process is a job, but not every job is a process
- One process can have multiple threads

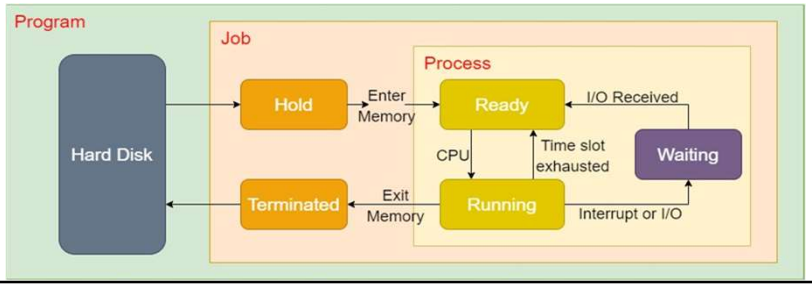


State Diagram

1. Program becomes Job when selected by OS and bring to Hold state
2. Once being loaded to memory, the Job moves to Ready state and becomes Process
3. When the CPU can execute the Job, it moves to Running state

In Running state, three things can happen:

- Process execution until I/O are needed→ move to Waiting state until I/O is complete
- Process exhausts its allocated time slot → move to Ready state
- Process terminates → move to Terminated state



Schedulers

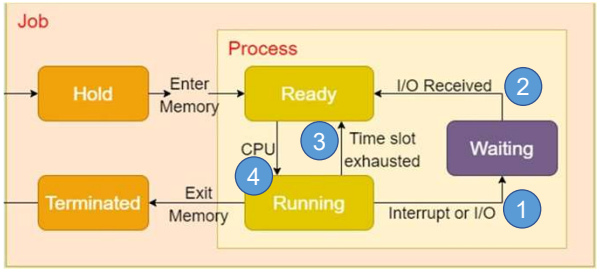
Move a Job or Process from one state to another

Job scheduler

- Create Process from Job: move Job from Hold to Ready state
- Terminate a process: move Job from Running to Terminated state

Process scheduler

1. Move a process: Running → Waiting
   - When the process is waiting for some (I/O) events
2. Move a process: Waiting → Ready
   - When the event is satisfied
3. Move a process: Running → Ready
   - When the process' time allotment has expired
4. Move a process: Ready → Running
   - When the CPU is ready to run the process



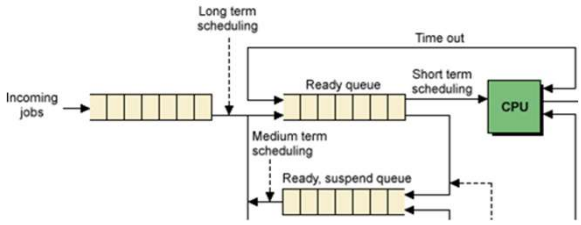
Queuing for Scheduling

Process manager uses queues (waiting lists) to store information

- Job/Process control block (PCB): store information about jobs or processes
- Process manager stores the job/process control block
- Job or process remains in memory (can be too large to be saved in a queue)

An OS can have several queues

- Job queue: hold jobs that are waiting for memory
- Ready queue: hold processes that are in memory, ready to be run, and waiting for CPU



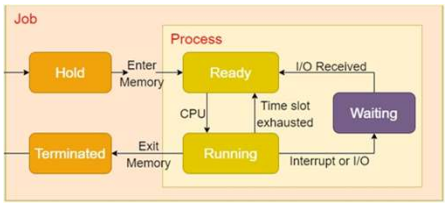


Image credit: https://www.technologyuk.net/computing/computer-software/operating-systems/process-management.shtml

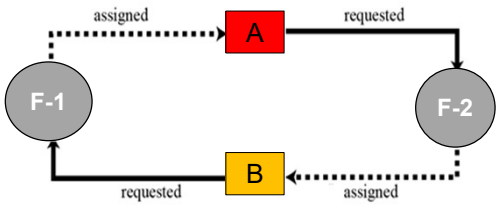
Deadlock

Deadlock occurs when the OS fails to put resource restrictions on processes

- If the OS allows the process to start running without first checking whether the required resources are ready
  - To avoid: cannot start running until the required resources are free
- If the OS allows the process to reserve resources as needed without restrictions
  - To avoid: limit the time a process can hold a resource

When resources are accessed by multiple users

- File-1 is assigned to process-A and cannot release until it acquires File-2
- File-2 is assigned to process-B and cannot release until it acquires File-1



Necessary conditions for Deadlock

The following four conditions are **all necessary** for deadlock to occur :

1. **Mutual exclusion**: only one process can hold a resource (cannot be shared by multiple processes)
2. **Hold and wait**: the process owns a resource, even if it cannot use it before other resources are available (still waiting for resources)
3. **No preemption**: OS cannot temporarily reallocate a resource
4. **Circular waiting**: all processes and resources involved form a loop

Deadlock prevention: preventing at least one of the four required conditions

- Different conditions require different approaches

Starvation

Starvation is the opposite of deadlock

- When OS puts too many resource restrictions on a process

Process-A needs file-1 & file-2

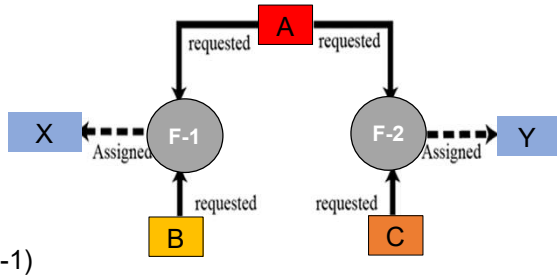
- File-1 is being used by process-X
- File-2 is being used by process-Y

Process-X terminates and release File-1

- Process-A cannot start as File-2 is still occupied
- Process-B is allowed to run (only requested File-1)

Process-Y terminates and release File-2

- Process-A cannot start as File-1 is still occupied
- Process-C is allowed to run (only requested File-2)



Week	Tentative Syllabus - Topics	TA Sessions	Assignment
1 (9/5)	Impact of digital technology	Brief Intro	
2 (9/12)	Computer Hardware	Hardware	
3 (9/19)	Operating System I 	1. Intro GitHub 2. Website Template	1. Create an account to access GitHub 2. Upload the template file to GitHub *Submit Team Members (up to 4 students)
4 (9/26)	*Online Session Operating System II 	*Online Session Prompt Practice: Deep Dream Generator	1. Create and revise figures on Midjourney 2. Upload the files to GitHub (5%)
5 (10/3)	*Online Session Internet & Network I & II	*Online Session MS Excel I	1. Excel VBA I (2%) 2. Upload the Excel file to your GitHub
6 (10/10)	*[National Holiday]*		
7 (10/17)	*Online Session Internet & Network III Digital Security and Privacy	*Online Session MS Excel II	1. Excel VBA II (3%) 2. Upload the Excel file to your GitHub
8 (10/24)	*[National Holiday]*		
9 (10/31)	Midterm (30%)	*Submit Final Project Topics (Propose 3 Topics)	

Distance Learning

Week	Tentative Syllabus - Topics	Lab	Assignment
10 (11/7)	Front-end Programming Language: HTML 	HTML	HTML Exercise Lab (2%) + HW (5%)
11 (11/14)	Front-end Programming Language: CSS	CSS	CSS Exercise Lab (2%) + HW (5%)
12 (11/21) 13 (11/28)	Final Project Discussion *Discussion Sheet (5%)	Supplementary Video Materials **Topic: Intro to AI** Prof. Justin Ku @ University of North Texas **Topic: Weaponized disinformation** Prof. Chiaoning Su @ Oakland University **Topic: Intro to Data Science** Prof. Sue Yeon Syn @ Catholic University of America	
14 (12/5)	Front-end Programming Language: JavaScript I 	JavaScript I	JS Exercise Lab (2%) + HW (5%)
15 (12/12)	Front-end Programming Language: JavaScript II	JavaScript II	JS Exercise Lab (2%) + HW (5%)
16 (12/19)	Final Project Presentation (30%)	Online Presentation: Gather Town	

Final Group Project

Topic: AI for Cultural Heritage or Elder Well-Being

1. Find someone who has similar interests for the final project
   - Form your team **wisely**, up to **4** students in a team
2. Discuss with your teammates and propose **3** potential topics
   - Effectively utilize the guest lectures' materials to your final project
3. Submit your team info and prioritize the proposed topics by Oct. 31
4. Final project discussion on Nov. 21 & Nov. 28
   - Prepare the discussion sheet to introduce your topics to the instructor and TAs
5. Demo day: final group presentation on Dec. 19
   - **Poster + Video**: provide your own opinions and solutions; cite your references- **DO NOT** copy and paste
   - Between-group evaluation: grade by the instructor, TAs and other groups
   - Within-group evaluation: grade by your team members, no free rider policy

Final Project Topic

Topic: AI for Cultural Heritage or Elder Well-Being

- How to use AI for cultural heritage (popularization, promotion)
- How to use AI for elder care (daily companion, healthcare, fraud prevention)

*bonus for proposals that bridge both (Cultural Heritage **&** Elder Well-Being)

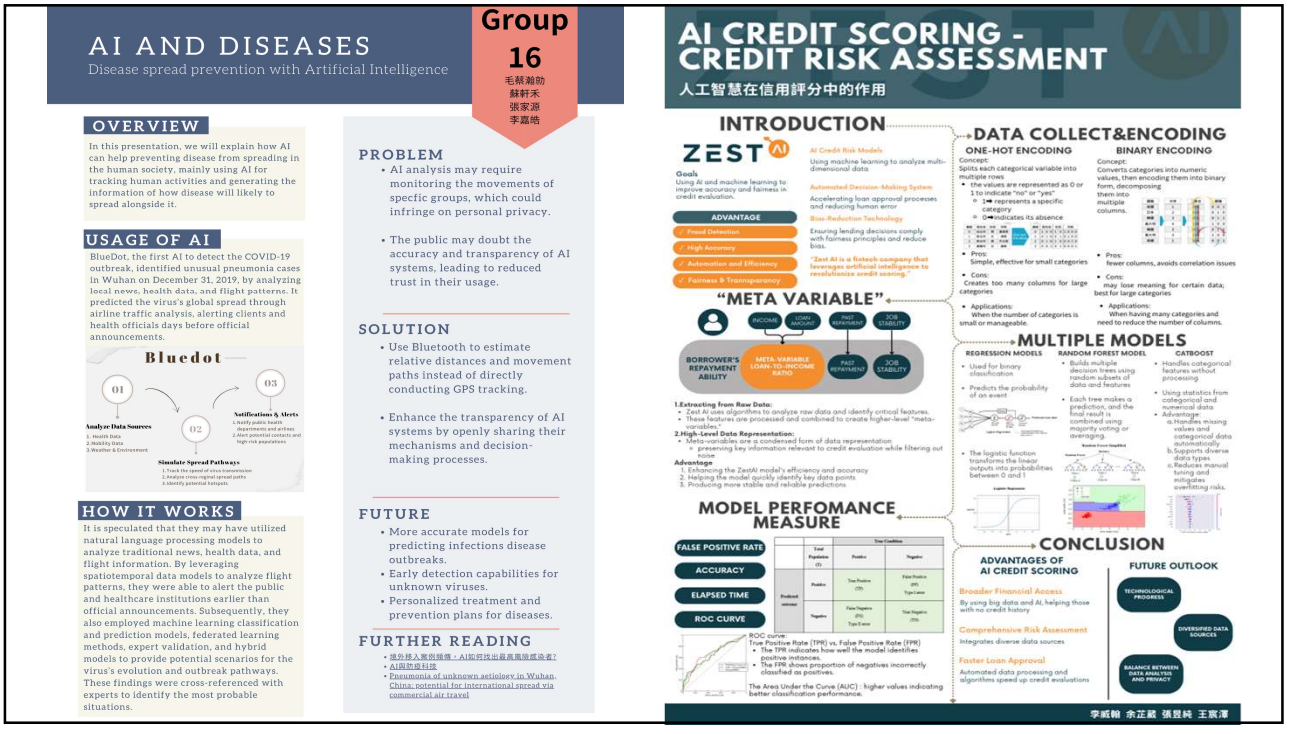
AI for Cultural Heritage

- *Oral History Auto-Curator*: Elders record local legends or memories using voice notes, and AI translates or clusters them by theme and generate story cards for visitors
- *AR Tea Tour Companion*: An app that overlays AI-generated tea culture facts during a self-guided walk around tea farm (e.g., Wenshan) and answers voice questions in real time

AI for Elder Care

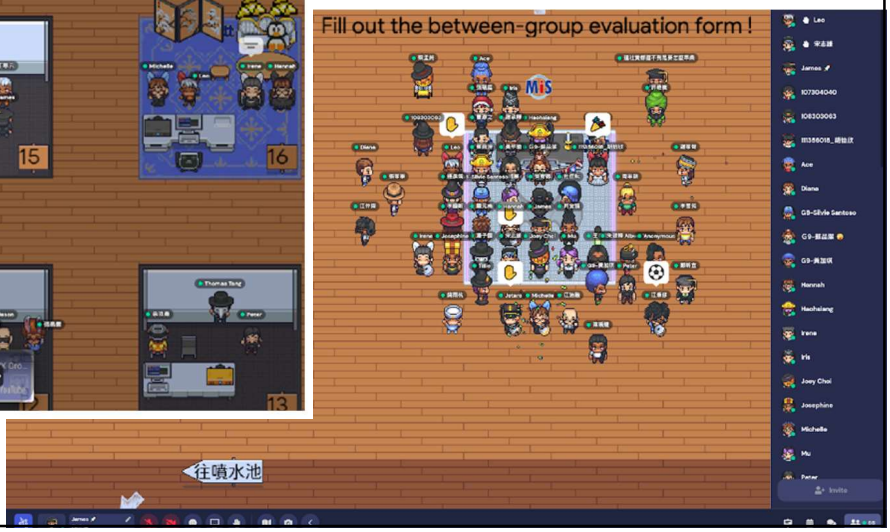
- *Emotion-Aware Daily Chatbot:* AI chatbot uses conversation cues (mood, energy, keywords like "tired," "alone," or "pain") to detect early signs of depression or illness
- *Fraud Prevention Chat Companion*: AI chatbot analyzes suspicious messages or calls and explains common scam signs in plain language


龜(歸)鄉永安一碇紅
首頁 | Home
常見問題 | Q&A
團隊成員 | Members
成果影片 | Videos
報導專區 | Reports
龜（歸）鄉永安一碇紅
讓食蛇龜回歸田園，年輕人重回家園
https://ppt.cc/fsY0xx
台灣藍鵲、山羌、食蛇龜安心在山林裡棲息，一梯一梯的茶樹在雨水的滋潤與土壤的孕育下生長，這裡是鄰近大台北都會區的新北市石碇區永安里。石碇區有85%以上的面積是森林，而永安里是石碇區面積最大的里，地幅遼闊的永安里有著豐厚的生態資源，以及輝煌的茶金歲月。旅客來到這裡，徜徉在山巒、雲霧與碧水之間，感受茶農們熱情款待的好茶，以及動植物多元共生的自然環境。
然而，在旅客眼中的這個坐擁山景與湖景的永安里，如今卻面臨著人口大量外移、產業後繼無人的危機。
翡翠水庫是全台第二大的水庫，全台每5個人就有1人喝的是翡翠水庫的水。為了讓大台北地區500萬民眾享有充足的水資源，翡翠水庫於1979年動工，海拔171公尺以下的區域全部變成了水庫的集水區範圍，居民的家園和茶園也隨同水庫的建立淹沒到了水底。由於翡翠水庫的興建，限制了當地產業的發展，失去家園的人們只能離開家鄉尋找更多的就業資源，如今，青壯年的身影已不復出現於村落。不僅如此，茶農們輝煌的茶金歲月，也隨之被淹沒至水下，日漸高齡的老農們精湛的製茶技藝也正面臨失傳的危機。
我們的用水都來自翡翠水庫，秉持著飲水思源的心，我們於2022年6月初次到永安里駐村，運用里山倡議與社區總體營造的精神盤點在地資源並組成學生團隊「龜(鄉)永安一碇紅」，本次計畫期盼進一步以青銀共學方式喚起在地長者的青春回憶，嘗試再現水庫淹沒前的永安茶現場，讓這片非山非市之地扭轉「產業空洞化」、「地方消滅」的重大危機。
團隊目標
「龜鄉」音同「歸鄉」，本團隊結合永安社區全台唯一的「食蛇龜野生動物保護區」以及石碇當地輝煌的茶產業結合，期盼在全台灣二十個永安里之中做出差異化，並為永安社區打造出以「龜」為特色的品牌，讓大家想到龜鄉就想到永安，想到永安就想到龜鄉，也為永安社區離鄉的人們找到一條「歸鄉」的路。
本團隊以「里山倡議」為核心價值，嘗試在駐村期間內盤點出永安社區發展「里山韌性」與「在地根經濟」的元素與潛力，為永安社區找出「人類社會與自然和諧共存」生活型態目標，與環境共融共好。


AI AND DISEASES
Disease spread prevention with Artificial Intelligence
Group 16
毛蔡瀚劭
蘇軒禾
張家源
李嘉皓
OVERVIEW
In this presentation, we will explain how AI can help preventing disease from spreading in the human society, mainly using AI for tracking human activities and generating the information of how disease will likely to spread alongside it.
USAGE OF AI
BlueDot, the first AI to detect the COVID-19 outbreak, identified unusual pneumonia cases in Wuhan on December 31, 2019, by analyzing local news, health data, and flight patterns. It predicted the virus's global spread through airline traffic analysis, alerting clients and health officials days before official announcements.
Bluedot
01
02
03
Analyze Data Sources
Simulate Spread Pathways
Notifications & Alerts
HOW IT WORKS
It is speculated that they may have utilized natural language processing models to analyze traditional news, health data, and flight information. By leveraging spatiotemporal data models to analyze flight patterns, they were able to alert the public and healthcare institutions earlier than official announcements. Subsequently, they also employed machine learning classification and prediction models, federated learning methods, expert validation, and hybrid models to provide potential scenarios for the virus's evolution and outbreak pathways. These findings were cross-referenced with experts to identify the most probable situations.
PROBLEM
• AI analysis may require monitoring the movements of specfic groups, which could infringe on personal privacy.
• The public may doubt the accuracy and transparency of AI systems, leading to reduced trust in their usage.
SOLUTION
• Use Bluetooth to estimate relative distances and movement paths instead of directly conducting GPS tracking.
• Enhance the transparency of AI systems by openly sharing their mechanisms and decision-making processes.
FUTURE
• More accurate models for predicting infections disease outbreaks.
• Early detection capabilities for unknown viruses.
• Personalized treatment and prevention plans for diseases.
FURTHER READING
• 境外移入案例幾時，AI如何找出最高風險感染者?
• AI與防疫科技
• Pneumonia of unknown aetiology in Wuhan, China: potential for international spread via commercial air travel
AI CREDIT SCORING - CREDIT RISK ASSESSMENT
人工智慧在信用評分中的作用
INTRODUCTION
ZEST AI
Goals
ADVANTAGE
✓ Fraud Detection
✓ High Accuracy
✓ Automation and Efficiency
✓ Fairness & Transparency
"META VARIABLE"
BORROWER'S REPAYMENT ABILITY
META-VARIABLE LOAN-TO-INCOME RATIO
PAST REPAYMENT
JOB STABILITY
MODEL PERFOMANCE MEASURE
FALSE POSITIVE RATE
ACCURACY
ELAPSED TIME
ROC CURVE
DATA COLLECT&ENCODING
ONE-HOT ENCODING
BINARY ENCODING
MULTIPLE MODELS
REGRESSION MODELS
RANDOM FOREST MODEL
CATBOOST
CONCLUSION
ADVANTAGES OF AI CREDIT SCORING
Broader Financial Access
Comprehensive Risk Assessment
Faster Loan Approval
FUTURE OUTLOOK
TECHNOLOGICAL PROGRESS
DIVERSIFIED DATA SOURCES
BALANCE BETWEEN DATA ANALYSIS AND PRIVACY
李威翰 余正威 張晏純 王宸澤

Online Project Presentation

Gather (gather.town)



TO-DO: Final Project

1. Find your teammates and form the team **wisely**
   - Up to **4** students in a team **(by Sep 19)**
   - Submit your team info
2. Discuss with teammates
3. Submit and prioritize the **3** proposed topics **(by Oct 31)**

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Name	Student ID	Email
Homer Simpson	112554141	Homer@simpson.com
Marge Simposon	112554142	Marge@simpson.com
Lisa Simposon	112554143	Lisa@simpson.com
Bart Simposon	112554144	Bart@simpson.com
Topic-1:	How AI Can Be Applied in Managing Global Pandemics: Le	
Topic-2:	Timely Fraud Alerts for Protection	
Topic-3:	Educating Users on Mobile Security	

https://ppt.cc/frt93x

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IntroToCS_2025_EN		
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https://ppt.cc/f589tx